Group Lending: Improving the Opportunity of SMEs Finance

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Abstract—**In practice, group lending is a lending method for SMEs with high repayment rate. Theoretical and empirical researches demonstrate the improvement of the credit market by group lending from the bank's perspective, which prove that group lending has information advantages and has extrusion effect to the risk group. This paper studies the function of group lending to relieve the situation of SMEs' finance problem from the SMEs' perspective integrating the characteristics of group making. The research indicates that rather than individual lending, group lending can provide loans with better interest rate. The better interest rate can lower the success probability of the enterprises which meet the loan participation constraint condition and lower the yield requirement of the borrower's project, and finally improve the loan chances of SMEs.**

Keywords—SMEs Group Lending; Network Joint Liability Credit Marketing

I. INTRODUCTION

China has been attaching great importance to SMEs development in recent years, with policies carried out after the Subprime Crisis and stronger supporting efforts in finance and taxation as well as credit for SMEs. However, financing has always been a major obstacle in SMEs development. At present, bank loans remains the most possible way for SMEs external funding in China when the multi-level capital market is still imperfect. Therefore, the funding solution to solve the dilemma for SMEs in China should enable banks to lower the credit risk while enable SMEs to afford such loan as well, which will practically improve the financing opportunity for SMEs.

In practice, Alibaba Corporation innovated a new SME lending mode named "Network Joint Liability (NJL)" to its e-Commerce clients which are mostly SMEs in 2007[1]. It has offered loans as much as 2.6 billion to 1,390 clients by the end of June 2009. The biggest size of NJL loan for each SME is RMB 2 million, and the average size is RMB 200,000. Its delinquency rate is only 1.08%, below the commercial bank delinquency rate announced by CBRC which is 1.77%[2].

The NJL loan is actually a new mode of Group Lending which is originated from Bangladesh. In NJL, three or more than three e-Commerce enterprises formed into a group to get a bank loan in which they take on the joint liability. If any of the group member breaks the promise, all other members should be responsible for repayment, or otherwise the group will be revealed as default on Alibaba's official site and any of them will never get loans either from NJL or from the bank.

Until now, the dead rate of Alibaba's NJL loans is still much lower than common credits. But is this loan model as unbearable as mortgage or collateral loans for SMEs? Most theoretical researches proved that joint liability loans or group lending can solve the financing dilemma for SMEs from the way of increasing repayment rate, not much attention was paid to whether SMEs can afford such loans and further improving financing opportunity.

This paper will testify whether group lending as an innovated financing method can improve SMEs' financing opportunities, comparing their financing chances given by group lending and individual lending under asymmetrical information. Section I is introduction, section II is the review on previous studies on group lending; section III is the model; section IV is summary.

II. LITERATURE REVIEW

Theoretical and empirical research of group lending all carried out from the perspective of bank. Most literatures analyze and prove how group lending can improve repayment rate and finally improve assets quality of banks, that is to prove group lending can effectively raise repayment rate by use of information advantage between companies based on joint debt. Among such studies, include Varian(1990)、Wenner(1995) 、 Ghatak（1999） 、 Morduch(1999) hold the opinion that in group lending, every member of the group would choose companion with low risk based on the private information it collected, which means member of high risk would be excluded. Such self-selection mechanism could be positive for the lift of repayment rate. Groups include Stiglitz(1990)、 Besley and Coate(1995)、Chowdury(2005) attributed the success of group lending to the inspiration of peer monitoring between group members, which would further relive the difficulty of moral hazard and contract enforcement. Besley and Coate(1995)、 Bemasek and Stainfield(1997)、Ghatak(2000) 、 Karlan, Dean S（2007） indicated that banks could make the most of social constraints through joint debt, which means that group members own comparative advantage, and other members would impose social restriction to a member once it was default, thus preventing the strategic default(means a company would not pay the loan although it had enough fund to do so). Research carried out by Yuan Zhang (2005) concentrated on crowding-out effect from safe groups to risk groups, thus improve the low efficiency issue in the credit market. Yuan Zhang (2005) ignored the effect of information advantage among group members.

The above researches were carried out from the angle of the supply of credit funds to prove the improvement group lending has brought to the credit market(include repayment raise and crowding-out effect on risk borrowing groups), however is such a loan model as unbearable as the mortgage and collateral loans for SMEs? No theoretical research studied the effect of group lending on relieving company's financing difficulty from the view of SMEs.

III.   MODEL

A.   The Financing Opportunities for Independent Lending

In this article, we assume that all the companies and banks are risk neutral. Provided each SME has a project, investment required as K, output of a successful project as Y^H, the difference between different SMEs is the probability of success(probability of success can be used to indicate different types of borrowing company).Probability of success of a project is marked as p_i, it is zero if the project failed. Considering the fund cost as r_i, and the labor opportunity cost equals to every unit of money invested as u, borrowers will offer the loan only when the project benefit surpassed the sum of fund cost and labor opportunity cost. We assume that project benefit between different borrowers is irrelevant. We also assume that all the projects are profitable, that is all the prospective benefit surpassed the fund cost and labor opportunity cost invested.

We can have the loan incentive constraints of one SME as,

$$p_i Y^H \geq r_i + u \qquad (1)$$

Set $p_0 = \dfrac{r_i + u}{Y^H}$, thus $p_i \geq p_0$, which means that when the company is having fund cost as r_i and labor opportunity cost as u, it will have the opportunity to get a loan only when the probability of success is above p_0.

China had completely released the upper limit for loan interest of commercial banks; in this case the bank can determine loan interest r_i based on its own condition. In the next step we need to understand how the bank determined r_i. This article used credit market assumption in SW model (Stiglitz, 1981), which means that price in credit market is set by the seller, the bank determine loan interest based on estimation of benefit, and the borrower decides whether or not to accept such an interest based on the prospective benefit in certain situation. In SW model, trade means a choice of take it or leave it for the borrowers.

1) Independent loan with complete information

In the next step we take bank owing complete information of borrowers as standard situation. Under complete information, bank can recognize all types company according to the fund cost and offer loan contract with interest of $r_i = \upsilon / p_i$ to the

borrowers with a probability of p_i (at the moment, condition for zero benefit constraints of the bank is, $r_i p_i = \upsilon$).

Theorem 1, For independent loans under complete information condition, boundary borrowing SMEs who satisfy the loan incentive constraints, with project output requirement of $Y^H \geq u + K\upsilon$, and type as $p_{\cdot}^0 = \dfrac{u + \sqrt{u^2 + 4K\upsilon Y^H}}{2Y^H}$, would own the motivation to borrow only when $p_i \geq \dfrac{u + \sqrt{u^2 + 4K\upsilon Y^H}}{2Y^H}$.

The proof is as follows. When considering the loan incentive, we use $r_i = \dfrac{\upsilon}{p_i}$ in the loan incentive constraint formula(1.1), to come out with a quadratic equation related to p_i as follows,

$$p_i^2 Y^H - u p_i - K\upsilon \geq 0 \qquad (2)$$

Let $f(p_i) = p_i^2 Y^H - u p_i - K\upsilon$, since $0 \leq p_i \leq 1$, to satisfy the company's loan incentive requirement, $f(p_i)$ should exist in an interval above zero when $0 \leq p_i \leq 1$. In $f(p_i) = p_i^2 Y^H - u p_i - K\upsilon$, it is clear that $f(0) = -K\upsilon \leq 0$, with symmetry axis of $p_x = \dfrac{u}{2Y^H} > 0$, therefore it is required that $f(1) \geq 0$, so, then we can come out with company's project output that fits the demand as

$$Y^H \geq u + K\upsilon \qquad (3)$$

Meanwhile, solve the quadratic equation $f(p_i) = 0$; we can get the boundary borrowing company as $p_{\cdot}^0 = \dfrac{u + \sqrt{u^2 + 4K\upsilon Y^H}}{2Y^H}$, only companies with $p_i \geq \dfrac{u + \sqrt{u^2 + 4K\upsilon Y^H}}{2Y^H}$ have the motivation to borrow.

2) Individualt loans with information cost

In fact, information usually has cost, and banks can not recognize the type of borrower with no cost. In order to get a low interest rate, high risk borrowers would pretend as low risk borrowers, however, if all types of borrowers get loan at a low interest rate, banks would not reach break-even. In such case, banks need to pay certain cost to recognize the type of borrowers when investigating borrowing SMEs.

Theorem 2, When it comes to individual loans with information cost, companies who satisfy the borrowing incentive constraints are required to have the project output as $Y^H \geq u + K\upsilon + \delta$, which is higher than the project output with complete information. The boundary borrowing company's type belong to $\hat{p}_0 = \dfrac{u + \sqrt{u^2 + 4Y^H(K\upsilon + \delta)}}{2Y^H}$, higher than same

probability under complete information as $p_0 = \frac{u + \sqrt{u^2 + 4K\upsilon Y^H}}{2Y^H}$, that is to say when information costs, a higher success probability of company is required and fewer companies can get loan.

The proof is omitted here, which is similar with theorem 1. The boundary probability to satisfy the company borrow constraints under complete information as $p_0 = \frac{u + \sqrt{u^2 + 4K\upsilon Y^H}}{2Y^H}$, it is obvious that $\hat{p}_0 \geq p_0$, which means that when information cost, the success probability for boundary borrow company increased, and there are fewer company to get the loan.

B. Research in the Company Financing Opportunities in Group Lending

1) Feature hypothesis of group composition in group lending

The paper cited the research conclusion of Maitreesh Ghatak(1999) to get the lemma 1 on group lending. The following are the feature hypothesis of group composition in group lending.

In group lending, as a result of joint liability, the success probability of other group members will have effects on one member's profit, so the consideration for other company's success probability is necessary when a company enters the group. To study the feature of borrowing company in group lending, this article quote the research conclusion of Maitreesh Ghatak(1999),Wei Zhang and Yaqin Gao（2008）, and the group composition features that come out are as following lemmas.

Lemma 1, All types of borrowers prefer low risk group, if the overall scale of borrowers is steady, then the only composition to satisfy the optimal sorting equilibrium based on the joint liability group lending is that all borrowers in a certain group has the same success probability.

Lemma 2, Before lending, banks only choose groups which satisfy the group composition features in social capital; after lending, under the punishment mechanism between members, there will be no strategic default among group members.

Based on the lemmas, the hypothesis of group lending composition feature between two members is as follows,

Members trust each other and are able to know and restrict others behavior, no strategic default will appear in this self-composed group. And once the project succeeds, the contract must be fulfilled. The composition of the group agrees with optimal sorting equilibrium, that is the project success probability of the two companies in the group are the same.

2) Opportunity improvement for SMEs financing in group lending

Under the hypothesis 1), study the opportunity improvement for SMEs financing in group lending will come out with the following theorem.

Theorem 3, for the same borrowing company, when the information is cost, group lending provides better financing opportunity than individual lending. In conclusion, compared to individual lending, group lending has a lower interest rate, a lower requirement for project output of SMEs that satisfy the company borrowing constraint and a lower type for boundary borrowing company.

It is proved as follows,

Under the group lending model, the constraint condition for company to join a group lending turns into,

$$p_i p_j Y^H + p_i (1 - p_j)(Y^H - c) \geq Kr_G + u \qquad (4)$$

c represents the joint liability in a group lending contract, which means when a member default, the successful members need to be responsible for that part of debt. From lemma 1, $p_i = p_j = p.$, we can have the following result,

$$p.^2 c + p.(Y^H - c) \geq Kr_G + u \qquad (5)$$

With regard to the bank, it needs to prevent the group from reporting a false project success probability in order to get a lower interest rate. In this case bank must pay the information cost to discover the situation of the whole group. Since the group is formed by members of the same success probability, the information cost δ of the bank just happens once for one group. So the zero profit constraint condition for the bank is as follows,

$$p.^2 2Kr_G + 2p.(1 - p.)(Kr_G + c) = 2K\upsilon + \delta \qquad (6)$$

Then, $r_G = \frac{\upsilon}{p.} + \frac{\delta}{2Kp.} - \frac{c(1 - p.)}{K}$. In the front we had the

loan interest rate as $r_i' = \frac{\upsilon}{p_i} + \frac{\delta}{Kp_i}$ when proving the bank's

requirement for independent lending; it is obvious that $r_G < r_i$, so for the same SME, group lending interest rate is less than the interest rate when information has cost, thus reduced the lending cost for companies.

Make $r_G = \frac{\upsilon}{p.} + \frac{\delta}{2Kp.} - \frac{c(1 - p.)}{K}$ in the company'

participation constraint condition (5), we can have the following formula,

$$2p.^3 c - 4p.^2 c + 2p.c + 2p.^2 Y^H - 2p.u - (2K\upsilon + \delta) \geq 0 \quad (7)$$

Provide $Q(p) = 2p.^3 c - 4p.^2 c + 2p.c$ and $f_G(p.) = 2p.^2 Y^H - 2p.u - (2K\upsilon + \delta)$, formula (1.7) turns into

$$Q(p.) + f_G(p.) \geq 0 \qquad (8)$$

Solve the inequation $f_G(p.) \geq 0$, we have the output demand below

$$Y^H \geq u + K\upsilon + \frac{\delta}{2} \qquad (9)$$

And the boundary value

$$\overline{p}_G = \frac{u + \sqrt{u^2 + 4Y^H\left(K\upsilon + \delta\right) - 2\delta Y^H}}{2Y^H} \qquad (10)$$

Calculating the range of continuous function $Q(p.) = 2p.^3c - 4p.^2c + 2p.c$, we get $Q(p.) > 0$ in the field of $p. \in [0,1]$. Back to the solving of the inequation $Q(p.) + f_G(p.) \geq 0$, we can have the value range of p_G that satisfy $f_G(p.) \geq -Q(p.)$.

Quadratic function $f_G(p.)$ has a symmetry axis of $p_x = \dfrac{u}{2Y^H} > 0$, $f_G(0) = -\left(2K\upsilon + \delta\right) < 0$ and $\overline{p}_G = \dfrac{u + \sqrt{u^2 + 4Y^H\left(K\upsilon + \delta\right) - 2\delta Y^H}}{2Y^H} > p_x$, so $\overline{p}_G$ stays in an increasing region and the p_G that satisfy the inequation $f_G(p.) \geq -Q(p.)$ should be smaller than $\overline{p}_G$.

From theorem 2, when information cost, for independent loans, company project success probability boundary value that satisfy the company join incentive constraint is $\hat{p}_0 = \dfrac{u + \sqrt{u^2 + 4Y^H\left(K\upsilon + \delta\right)}}{2Y^H}$, and the requirement for company success project output is $Y^H \geq u + K\upsilon + \delta$. It is obvious that when $\overline{p}_G < \hat{p}_0$, there will be $p_G < \overline{p}_G < \hat{p}_0$. So under such group lending mechanism, there will be more companies that satisfy the lending join constraint condition under the interest rate set by bank and get the loan, and the requirement for project success output in group lending as $Y^H \geq u + K\upsilon + \dfrac{\delta}{2}$ is lower than that of a independent lending.

It can be clearly seen that based on the optional composition mechanism, company choose to form a group with the company of the same project success probability, which de-creased the information cost for the bank used to evaluate and investigate every member of the group. For the same company, group lending can provide more favorable loan interest rate than independent lending, and can lower the requirement for project success probability of member, also can lower the out-put requirement for a company when the project succeed, thus improved opportunity for SMEs to get loan.

IV.   SUMMARY

This article started from the composition feature of group lending, the financing opportunity given to SMEs under incomplete information condition of both group lending and individual lending. Study shows that based on the optional composition mechanism of a group, SMEs choose to form a group with the company of the same project success probability, which decreased the information cost for the bank used to evaluate and investigate the group. For the same company, group lending can provide more favorable loan interest rate than individual lending, and can lower the requirement for project success probability of SME, also can lower the output requirement for SMEs, thus improve opportunity for SMEs to get loan. These conclusions can provide theoretical foundation for further application of group lending.

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